TERM

The Tank Extended Range Munition

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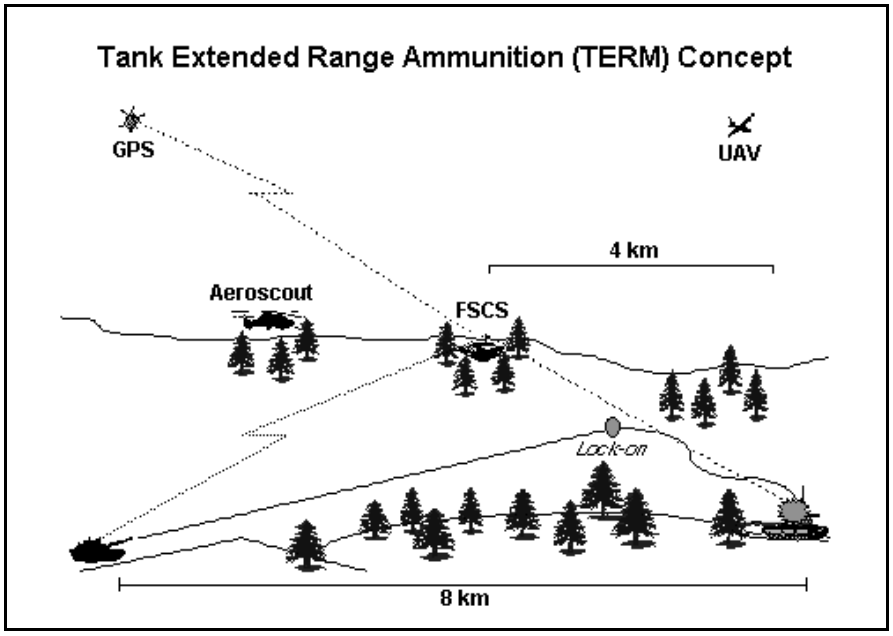

"Technical improvements in maneuver weapons systems, such as advanced optics, increased ranges, and digital electronics, will have a dramatic impact on tactical battlespace. Army maneuver forces — operating at an operational tempo controlled by the commander within a given battlespace — will use an expanded array of weapons systems to engage enemy forces at greater distances with assured accuracy. Based on enhanced situational awareness, the operating tempo of these forces will be such that they will be able to outpace any adversary in mounted warfighting environments."

-TRADOC Pamphlet 525-5

Force XXI operations present new paradigms for the employment of the Armor Force. The process began with the fielding of the M1A2 and its advanced digital capabilities. It continues with the development of Force XXI systems and doctrine. As the implementation of Force XXI continues, the volume, accuracy, and speed of information and targeting data available to commanders is growing, as is their ability to use this information to impact the battle in their area of influence. The development of the Smart Target Activated Fire and Forget Round (STAFF) also introduces the increased range and lethality of smart munitions to the Armor commander to extend his reach beyond the traditional ranges of close combat direct fire engagements. Improvements in target acquisition represented by the introduction of advanced Forward Looking Infrared (FLIR) sensors and other future target acquisition systems, integrated in both tank and scout platforms, provide the capacity to use tank extended range munitions to the maximum range of the commander's situational awareness. This may significantly impact the commander's ability to engage targets outside traditional close combat ranges but still within his close combat fight. The purpose of this article is to explain the concept of a tank extended range munition (TERM) and how this technology can support Armor's role in Force XXI Operations.

TERM

The Tank Extended Range Munition (TERM) concept proposes to combine emerging technologies in digitization, target acquisition, and warheads with advanced vehicle and tank main armament design to provide an enhanced engagement capability to the armored force. The focus is to provide an offensively-oriented close combat force with a lethal long-range engagement capability. This capability can engage "beyond line of sight" (BLOS) targets where the firing tank does not have intervisibility with the target. This "indirect" capability is analogous to the ability of attack helicopters to fire engagements initiated by their scout aircraft or other reconnaissance assets.

The concept would provide the tank with an extended range precision guided munition (several options, both missile- and projectile-based, are being considered). Target acquisition could be made by the combat vehicle itself or, more probably, by another asset (scout) linked in its digital architecture. The tank would be able to engage designated targets with the guided munition when beyond line of sight, engage with long-range guided direct fire when the tank achieves line of sight, and, finally, engage with conventional direct fire cannon ammunition if required.

The scout, possibly with an elevated platform or sensor package as envisaged by the Future Scout and Cavalry System (FSCS), improves the tank's probability of acquisition. Situational awareness/combat intelligence in a digitized force can cue the scout sensor platform where to search for targets, minimizing exposure time for both the scout and the firing platform. Once the scout platform acquires the target, it could hand off that target to the tank platform for beyond line-of-sight engagement. In this case, the scout would digitally identify the target before the tank fired the precision guided munition. The tank would then fire (in a fire-and-forget mode) relying on the munition sensor package or the scout's designation to complete the engagement. The capability would be integral to the close combat maneuver force, and **not** a fire support asset. The organic relationship and the ability to pass digital target information provide essential system responsiveness.

The system concept could use several different acquisition and guidance strategies to fire the long-range engagements. First, the scout could designate the target and pass the digital target data package to the tank. The tank's on-board computer and fire control system could then calculate the firing so-

lution to launch the round into the firing area, where the munition would then scan for the target designation. Once the munition was fired, the scout could then re-designate the target with a laser (or other low-probability-of-intercept designator) and the munition would home on the painted target. Second, the munition might be equipped with a terminal guidance package whose sensors would search for the target once it entered the target area. The scout would send the target data set to the tank which would compute the fire control solution that would put the munition in the best search aspect for acquiring the target. This scenario would then use the round's own sensors and guidance to maneuver to the target and complete the engagement.

The choice between target designation and munition terminal guidance offers different trade-offs in terms of cost, complexity, and operational impacts. These issues are being evaluated as part of a TERM concept study. Additionally, several possible kill mechanisms are being considered for the munition, including top-attack tandem HEAT, Kinetic Energy (KE) penetrators and Explosively Formed Projectile (EFP) warheads. The design is being optimized to maximize P(k) on a 2015 threat tank with explosive reactive armor cassettes, active protection systems (APS), and top-attack protection.

The TERM Concept Study

The TERM concept is currently being examined by a study group of research and development organizations as a lethality mechanism applicable to the Abrams or a Future Combat System (FCS). Both systems are currently being defined by TRADOC/USAARMC requirements Integrated Concept Teams (ICTs). The study team evaluated concepts, helped assess the operational payoff, and identified critical factors that must be considered in the design of a TERM system.

The Phase 1 TERM study considered seven concept alternatives provided by the Armament and Missile Research and Development Centers. These were:

- a tank-launched, precision guided mortar round with a tandem warhead
- a smart, long-range missile with a tandem warhead
- a smart top-attack multipurpose round with a unitary CE warhead
- a guided, smart, top-attack, fire-and-forget round (flyover shoot down)
- a LOS-only, tank-launched kinetic energy missile
- a LOS-only, guided, kinetic energy round
- a LOS/BLOS KE munition (either missile or bullet)

The study group examined the impacts of a TERM-capable tank through both technical and operational analysis. The technical analysis evaluated the feasibility of the concepts and assessed design challenges. The study included two LOS-only concepts that provided extended range but no BLOS capability. This provided a useful comparison of these capabilities. The tank-launched, precision-guided mortar round, fired in the BLOS mode only, provides another useful capability benchmark.

The analysis disclosed several important findings. First, operational tempo appears to be increased by TERM, allowing the battle to finish more quickly. Second, TERM promises logistical savings in ammunition expenditure, making a TERM-equipped Armor force more independent and flexible. Finally, TERM provides a significant operational payoff in increased combat effectiveness. This payoff was measured in both significant increases in lethality at extended range and a positive effect on survivability, reducing tank losses. All of these insights have implications on how Armor might fight on the future battlefield and will be examined in the next phase of the study.

In the scenario, TERM's BLOS usefulness was dependent on the nature of the terrain; it has a greater relative impact where the probability of LOS is rare. Where long-range line-of-sight exists, such as in the desert, TERM engagements were found to be more likely to be self-designated. Where the terrain is more broken, BLOS engagement becomes the norm and has a greater payoff. The ability of the scout to remain undetected, both through stealth and signature management, is critical to perform BLOS engagements. A Future Scout and Cavalry System (FSCS) could provide these key capabilities. UAVs and Aviation assets may also perform target acquisition/reconnaissance missions, provided the weather is good, these platforms are available, and threat anti-air assets have been neutralized.

TERM effectiveness is also affected by threat active protection systems (APS). Concepts that are slower-moving flyers or have a shallow angle of attack are affected by APS. Design of counteractive protection systems (CAPS) or trajectory shaping must be utilized to minimize the effect of APS on these systems. Flyover-shoot down concepts or fast-moving, guided, kinetic energy penetrators perform much better against likely threat APS systems. The exact capabilities of future threat APS systems are still a subject of study, and as further details and analysis are available, new strategies for their defeat can be developed.

The TERM concept, by offering a high probability of kill given a shot, also offers an opportunity to attack more vehicles with fewer rounds. TERM munitions, properly designed, will be very efficient from the point of view of stowed loads and the amount of ammunition to be transported. This will be critically important in a more amorphous, non-linear battlefield, enhancing the Armor unit's ability to range more freely and with a shorter logistics tail.

Armored forces equipped with TERM could simultaneously engage targets throughout their area of operations. This effect works to the advantage of both close combat and fire support systems. It allows fire support assets to concentrate on high-value targets and missions deeper in the battlespace, while allowing the close combat commander increased control over his battle. This could allow the Armor commander to dominate his expanded battlespace with a minimum number of systems and more completely impact his defined area of operations without calling on fire support systems.

In the model, what kind of operational impact did TERM make? The TERM-equipped FCS increased the force loss-exchange ratio (total red losses to blue losses) over the baseline between 17%-58%. The TERM-equipped tanks improved their system exchange ratio (red losses per blue tanks lost) 76%-263% (depending on the specific concept and scenario used). The findings showed a clear improvement in lethality over the base case. The blue tank exchange ratio for several concepts was better than 20 to 1. The use of TERM also impacted survivability, reducing blue tank losses between 11%-34%. TERM also reduced the average number of rounds per kill by as much as a factor of four. The results of the study clearly indicate that TERM provides the promise of a big payoff in both operational effectiveness and operational suitability.

Conclusion

Ultimately, an Armor Force equipped with TERM could increase the Force XXI Armor commander's ability to control an expanded battlespace and conduct rapid offensive operations in depth as indicated in Force XXI doctrine. If the Armor force is to remain relevant on the future battlefield it must integrate the Force XXI doctrine and architectures with advanced weapons and sensor systems to fully exploit the expansion of the maneuver commander's battlespace. A TERM can provide the digitally-equipped, scout-tank, hunter-killer team with a tool that could revolutionize how we fight and even how we organize an Armor force.

Lieutenant Colonel John Woznick is a 1976 graduate of the State University of New York at Geneseo with a bachelor's degree in biology. After OCS in 1977, he attended the Armor Officer Basic Course, served as a cavalry platoon leader and tank company XO in the 2d ACR. Following AOAC, he was assigned to the 194th AR BDE where he served as an operations and intelligence officer (S2/3), battalion motor officer, and tank company commander. He then served as a research and development coordinator at Benet Laboratories, U.S. Army Armament Research, Development, and Engineering Center (ARDEC). While there, he was admitted into the Acquisition Corps. After CGSC, he earned a masters degree in Materiel Acquisition Management from the Florida Institute of Technology. He served as branch chief for Command, Control, Communications, and Computers and later the Cavalry Branch Chief in the Directorate of Combat Developments, Ft. Knox. He attended the Defense Systems Management College's Program Manager's Course, at Ft. Belvoir, Va., and is currently Armor Technology Manager for the Army Research Laboratory.